there appears to be some trustworthy evidence that tsetse-flies, including even *G. morsitans,* can exist in numbers where big game is negligible as a food supply.

These wider questions are beyond the scope of Mr. Austen's handbook, which, however, contains a store of information which will be invaluable to those who are seeking to free Africa from the tyranny of these dangerous pests.

G. A. K. M.

THE PSYCHOLOGIST AND THE TEACHER.

The Psychology of Education. By Prof. J. Welton. Pp. xxi+507. (London: Macmillan and Co., Ltd., 1911.) Price 7*s.* 6*d.* net.

WHATEVER criticism Prof. Welton's book may excite, it is undeniably interesting—the most interesting book dealing with its particular problems that has been produced in recent years. With great ability and clearness, the author has drawn a map of life, not as the adult lives it, but as it develops in form and complexity from infancy to manhood. The teacher and the situations with which he deals are in his mind all through. His book is therefore not a treatise on psychology, yet the psychologist's point of view is so dominant that neither does it set forth a theory of education. This Prof. Welton makes clear in his preface. His concern is with the connections between the two—psychology and education—and especially to give a psychological explanation of educational procedure.

The book will surely make a very strong appeal to experienced teachers, for its style is attractive and conspicuously free from abstruse technicalities of expression. Indeed, one is tempted to think that the author has been over-anxious to conciliate the teacher. His opening chapter is particularly addressed to the practical man, who will not fail to note that the psychology which "alone is of worth to the educator" is that "which comes from constant and sympathetic intercourse with children." Although careful reading makes it clear that Prof. Welton means less than he seems to say, it is a mistake, we think, even to seem to imply that all good teachers are willy-nilly good psychologists. There is a distinction between psychological knowledge and a practical acquaintance with psychical relations which comes from experience. The child who uses a brick differently from a ball is not a physicist, nor does social tact constitute a claim to knowledge of psychology. "Every true educator is always making use of real psychology." Is then every true farmer always making use of real chemistry?

The restrictions which the author laid upon himself have led to some difficulties. He very rightly protests against the implicit view of so many child psychologists that children are different from men by reason of their incompleteness.

> "Progress is not from a mutilated and incomplete mind to one which possesses all its organs. At every stage of his development, a child's experience is as full and satisfying to him as is that of a philosophical psychologist to himself."

Instead of the serial appearance of new powers to determine the order of which is the main task of the genetic psychologist, his aim should be to show how such development is brought about. All this is admirably put, and as admirably describes the author's object.

In his effort to avoid technical language, however, Prof. Welton has not always been able to achieve satisfying analyses of the processes he describes. In his discussion of the nature of imitation, he restricts the use of the word to what most psychologists call deliberate imitation. This is, of course, giving the word a technical sense, for we call monkeys imitative, though we may deny their intention to imitate. It is no doubt to the writings of M. Tarde that Prof. Welton's protest is due. M. Tarde would find an element of imitation in all that we do, and a term which includes so much tends to obscure rather than to clarify thought. Our author has a second objection to the current use of the word in psychology. To call an action imitative when there is no intention to imitate is to describe its external rather than its psychical attributes. There is a certain justification for this criticism, but it is doubtful whether Prof. Welton's way out of the difficulty helps very much. He would avoid confusion by including all the non-volitional forms of imitation under the term assimilation—the general tendency of man to assimilate his mental life to that of his fellows. But how does such a term suit a case like that of Preyer's tiny infant who pursed his lips as he watched his father doing so? Surely this is distinguishable in analysis from catching the enthusiasm of a crowd.

These all-embracing words—assimilation, apperception, &c.—are a great difficulty in teaching psychology, and for that reason a precise technical terminology cannot be dispensed with. It is as necessary in this subject as in botany, if it is to justify its claim to rank as a science. The whole chapter on the nature of experience is the least convincing in a book which is otherwise extremely readable, and sane to the point of conservatism. No teacher can fail to find much that is helpful in its pages, though he must not expect to get from it an introduction to the methods and results of recent pedagogical inquiry. This Prof. Welton has deliberately left out, except for a gentle gibe at those who use chronoscopes, ergographs, and other terrible machines.

The book is admirably printed, and altogether a valuable addition to English educational literature.

J. A. Green.

TIMBER AND PAPER.

Wood Pulp and its Uses. By C. F. Cross, E. J. Bevan, and R. W. Sindall. With the collaboration of W. N. Bacon. Pp. xi+270. (London: Constable and Co., Ltd., 1911.) Price 6*s.* net.

"THE present is a Cellulose Age," remark the authors of the book before us. Their statement is not made *ad captandum*: it will, they urge, survive critical examination.

Perhaps in their epigram there is just a tinge of the spirit which makes every mother's goose a swan; but be that as it may, there is no doubt that cellulose plays a very important part in modern life. In the

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clothing of men's bodies, as in the nurture of their minds, the difference between our own times and those of, say, the Stone age is obviously enormous; and—though this may be less obvious—the difference largely depends upon cellulose. For, not to mention high explosives and celluloid articles, if paper and papyrus, if cotton, flax, and similar textile materials are taken from us, we are back in the days of potsherd writing-tablets, woad, and fig-leaves—back, in fact, to an early stage of civilisation.

Typically cellulose is the purified fibre substance of cotton. Wood-pulp is a special combination of cellulose. In the fibres of wood, the cellulose is associated with substances which have the essential chemical characters of the di-ketones, and hence are designated "lignones." These are chemically much more reactive than the cellulose. Lignones, for example, are very susceptible to oxidation, even by the oxygen of the air, in this respect differing notably from cellulose. Hence paper such as modern "news" paper, which contains ligno-celluloses from wood-pulp as a constituent, on exposure to air and light becomes readily discoloured, and loses its tenacity. The ligno-celluloses are the essential fibrous components of "mechanical" pulp, which is merely wood disintegrated into its constituent fibres by grinding. On the other hand, since lignone is attacked by chlorine, by alkalis, and by alkali bisulphites, it can be separated with these reagents more or less readily from the cellulose with which it is associated, leaving the latter substance in a tolerably pure condition. This product is "chemical" wood-pulp ("soda" or "sulphite" pulp); it differs materially from, and is superior to, the fibre obtained by the mechanical process. Common "news" paper contains about 80 to 90 per cent. of mechanical wood-fibre, and 10 to 20 per cent. of wood-fibre which has been treated chemically; in high-class "news" paper these proportions are reversed. Naturally, "mechanical" wood-pulp is excluded from paper intended for permanent documents. It serves a useful purpose, however, in enabling the demand for cheap publications to be met.

Since cellulose in a more or less pure form can be separated from wood as "chemical" wood-pulp, the question naturally arises whether such pulp cannot be used as a source of cellulose for the production of textile fabrics, high explosives, and celluloid articles. Its relatively low price would seem to give it a considerable advantage. In fact, some success has been met with in respect of the first-named group; for example, in the manufacture of wood-pulp yarn ("silvalin") and of artificial silk (from "viscose"). But the shortness of the fibres is a serious limitation to the use of wood-celluloses for textile purposes. As regards the other groups, wood-cellulose when nitrated has been found to be less stable than cotton-cellulose nitrated to the same degree, and is therefore less suitable for these industrial uses.

The chief woods employed for the manufacture of "sulphite" and "mechanical" pulps are spruce, fir, and pine. For the production of "soda" pulp, aspen, conifers, poplar, and other deciduous trees are utilised; whilst hemlock wood is much used in the making of wrappers and "fibre" papers. After two introductory chapters, the authors discuss the sources of supply of such woods, and then proceed to describe the various operations involved in the manufacture of the several kinds of pulp. The rest of the book deals chiefly with the conversion of the pulp into paper and cardboard, and with its relation to the textile industries.

Professedly the work is written for the general reader, but there is much in it that would be appreciated by the young chemist beginning to specialise in cellulose products. Occasionally the style is heavy and not too clear; but the volume as a whole gives a good general idea of the wood-pulp industry, and the authors' names are a guarantee of its trustworthiness.

C. SIMMONDS.

DR LUNGE AND THE LEBLANC PROCESS OF ALKALI MANUFACTURE.

The Manufacture of Sulphuric Acid and Alkali with the Collateral Branches: a Theoretical and Practical Treatise. By Prof. G. Lunge. Third edition. Vol. iii., Ammonia-Soda, Various Processes of Alkali-making, and the Chlorine Industry. Pp. xix+764. (London: Gurney and Jackson, 1911.) Price 30*s*. net.

THESE handsome volumes, which we owe to the tireless industry of the emeritus professor of technical chemistry in the Federal Polytechnicum of Zürich, bring the history of the development of alkali manufacture and of its associated industries down to its latest phase. During the dozen or more years which have elapsed since the appearance of the last edition of Dr. Lunge's monumental work, considerable changes have occurred in this department of chemical technology which bid fair, in the fulness of time, completely to revolutionise its methods. A significant feature of modern manufacturing industry is the ever-growing application of electrical energy to its processes, and in no field of production has this application been more fruitful in consequences than in that of industrial chemistry. Although there is, even now, scarcely a single section of applied chemistry which has not felt the influence, directly or indirectly, of this form of energy, it is almost a truism to assert that we are only at the threshold of the new departure.

Dr. Lunge's books bring the story as far as the parting of the ways. He is the faithful chronicler of contemporary achievements, the historian *temporis acti*. He is concerned mainly in giving as full and as accurate a picture of the state of alkali manufacture at the end of the first decade of the twentieth century as is possible to him. As a faithful reflex of the present state of this manufacture the volumes before us suffer from the limitation that they deal only with what have grown to be subordinate processes—that is, processes which are dependent upon the conversion of common salt into alkali through the instrumentality of oil of vitriol, or, in other words, the Leblanc method of manufacture and its associated industries. The supremacy of this method has long since passed away by reason of the elaboration and development of the ammonia-

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